Space Weather Technical Forecast

Issued on Monday, 17 June 2024 at 12:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Isolated M-class flares (R1-R2 radio blackouts) likely throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is moderate, with two M-class flares from AR3712, the largest of which was a M1.5 flare peaking at 17/0804UTC.

There are currently seven sunspots on the disc. The most complex groups all lie close to centre disk, foremost amongst these AR3712. This region continues to display significant magnetic complexity with multiple small delta spots visible, although overall evolution and spot development appears to have slowed in recent hours. Also of note is AR3716, which has shown some merging of its intermediate spots, perhaps a sign of slight stabilisation. The other regions on the disk appear generally stable or are in decline.

No clearly Earth directed CMEs were in evidence in available imagery at time of issue, although a recent Type II Radio emission associated with the second of the recent M-flares from AR3712 at 17/1100 UTC suggest the potential for a CME, this will be assessed if and when it becomes visible on coronagraph imagery.

Solar Wind / Geomagnetic Activity: Solar winds were mostly slightly elevated, as observed by ACE at L1, initially averaging around 380-420 km/s they increased to around 430-460 km/s following suspected coronal hole at around 16/1430 UTC, with a second increase to 500-520km/s perhaps associated with a more solid connection with CH45/+ observed from 17/0300 UTC. Although this fairly brief with speeds reverting to previous levels from around 17/0800 UTC. Density was at below to just average levels. The Interplanetary Magnetic Field (IMF), Bt, was fairly erratic at weak to moderate levels, with a maximum value of 10nT recorded. The north-south component oscillated between +7 and -7nT. Phi angle oscillated between positive (away from the sun) and negative (towards the Sun) during the period, finishing positive. The resultant geomagnetic activity was largely Quiet to Unsettled (Kp1-3) but became Active (Kp4) for the 16/1800-2100 period.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at resting background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at normal background levels, with the associated 24-hour fluence well below Active. Observed fluence at 17/0001UTC was 1.0e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Isolated M-class flares are likely, with a slight chance of isolated X-flares. This risk primarily from AR3712.

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Met Office Space Weather Technical Forecast

Solar Wind / Geomagnetic Activity: The solar wind is currently slightly elevated at around 450 km/s, likely from an erratic connection with CH45/+. Slightly elevated solar wind speeds of 450-500 km/s are expected to continue for day 1 (17 June) and much of day 2 (18 June), before declining back to background into the second half of the period.

Geomagnetic activity is expected to remain at largely quiet to unsettled levels (Kp1-3) for much of the period. During days 1-2 (17-18 Jun) isolated Active (Kp4) intervals are likely, with just a slight chance of isolated G1/Minor Storm intervals (Kp5) due to connection with the aforementioned coronal hole.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at Background levels, with just a slight but increasing chance of reaching S1 levels following any significant flares.

High energy electron flux is forecast to persist at predominantly Background levels, and the associated 24-hour fluence is expected to remain below the Active threshold.

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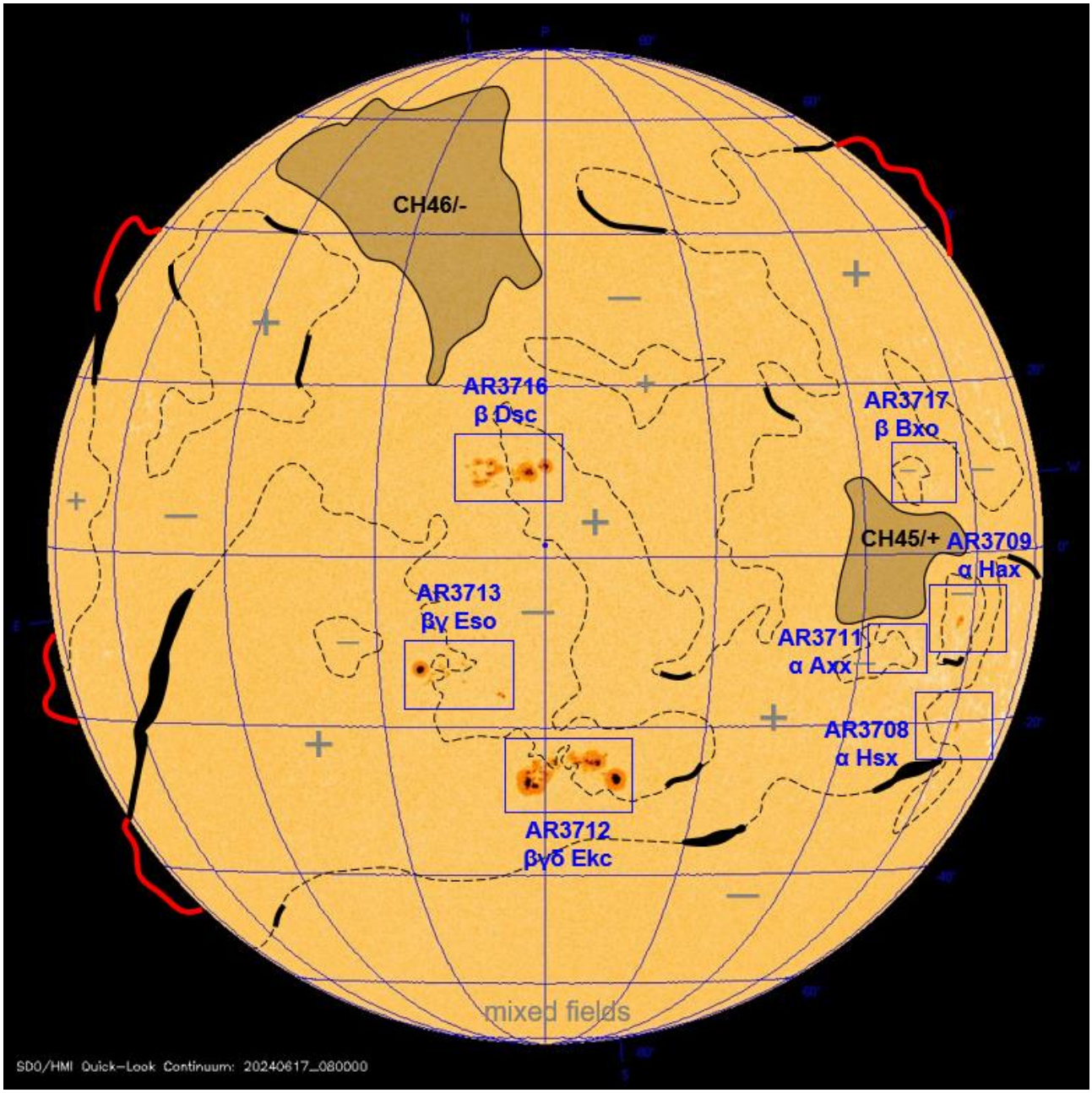
Figure 1. Solar Analysis Valid 17/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs currently feature in the forecast.

The solar wind is currently slightly elevated at around 450 km/s, likely from an erratic connection with coronal hole CH45/+. This feature is not recurrent and is therefore something of an unknown quantity. However due to our proximity to the solstice it is not expected to have a significant geomagnetic impact. Spells of slightly elevated solar wind speeds of 450-500 km/s are expected to continue at times through day 1 (17 June) and much of day 2 (18 June), before declining towards background into day 3 (19 June) onwards.

Geomagnetic activity is expected to remain at largely Quiet to Unsettled levels (Kp2-3) to start the period. During day 1 (17 Jun) and into early day 2 (18 Jun), isolated Active (Kp4) intervals are likely, with just a slight chance of isolated G1/Minor Storm intervals (Kp5). Into days 3 and 4 (19-20 Jun) activity is currently expected to revert to generally Quiet levels (Kp1-2).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity – Earthbound Coronal Mass Ejections

Nil

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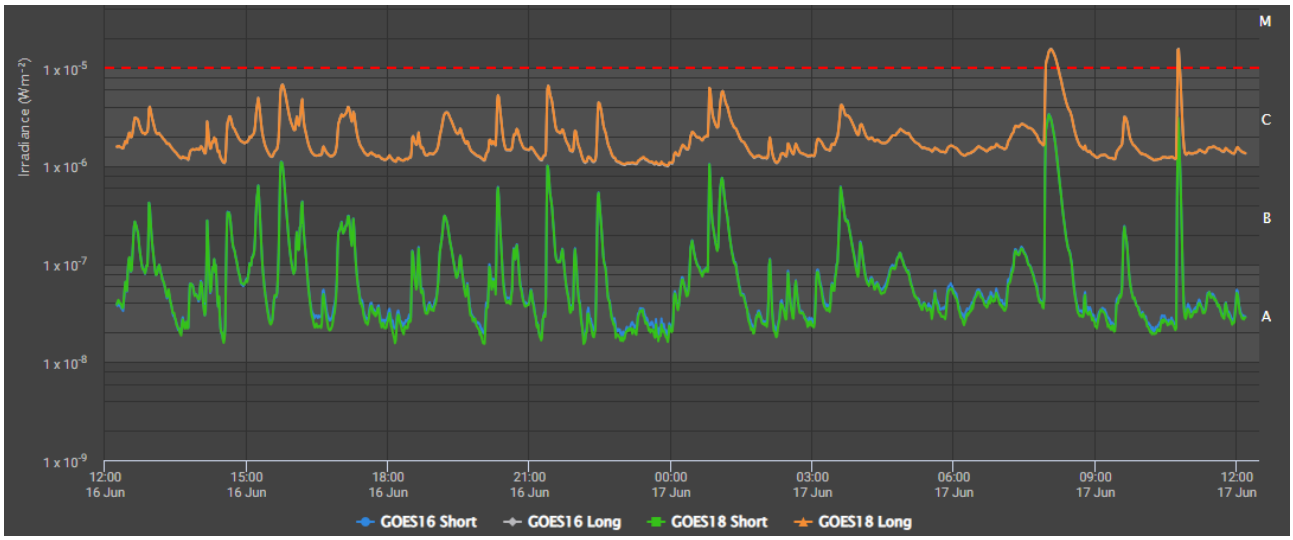
Radio Blackouts - X-Ray Flares:
The chances of significant flares looks to be primarily tied to the large AR3712, and to a lesser extent AR3716, with these two regions undergoing significant growth phases in recent days. Both of these sunspot groups now present as having 'compact' Zurich classifications, while AR3712 retains multiple small Mt Wilson delta spot. Other regions on the disk appear generally stable or are in decline, with the majority of flare activity in the past 24 hours emanated from AR3712.

Isolated M-class flares are viewed as likely going forward, with a slight chance of isolated X-flares primarily from AR3712. No significant sunspot regions are expected to depart the visible disk during the period with far-side sounding data also suggesting only limited oncoming spot regions, although persistence would suggest the potential for returning region later into the period. Overall the risk is held constant for now, pending further developments.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 2: Latest 24hr GOES16/18 X-ray flux trace



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux is at background levels. In terms of the future risk, the most significant regions on the visible disc are currently approaching centre-disc. The daily risk of surpassing S1 is low but shows a slight increase into the period as AR3612 begins to move into a potentially more geo-effective position in the western hemisphere from later day 2 (18 Jun) onwards.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	15	15	15
Very Active	**≥ S3 ***	No	1	5	5	5

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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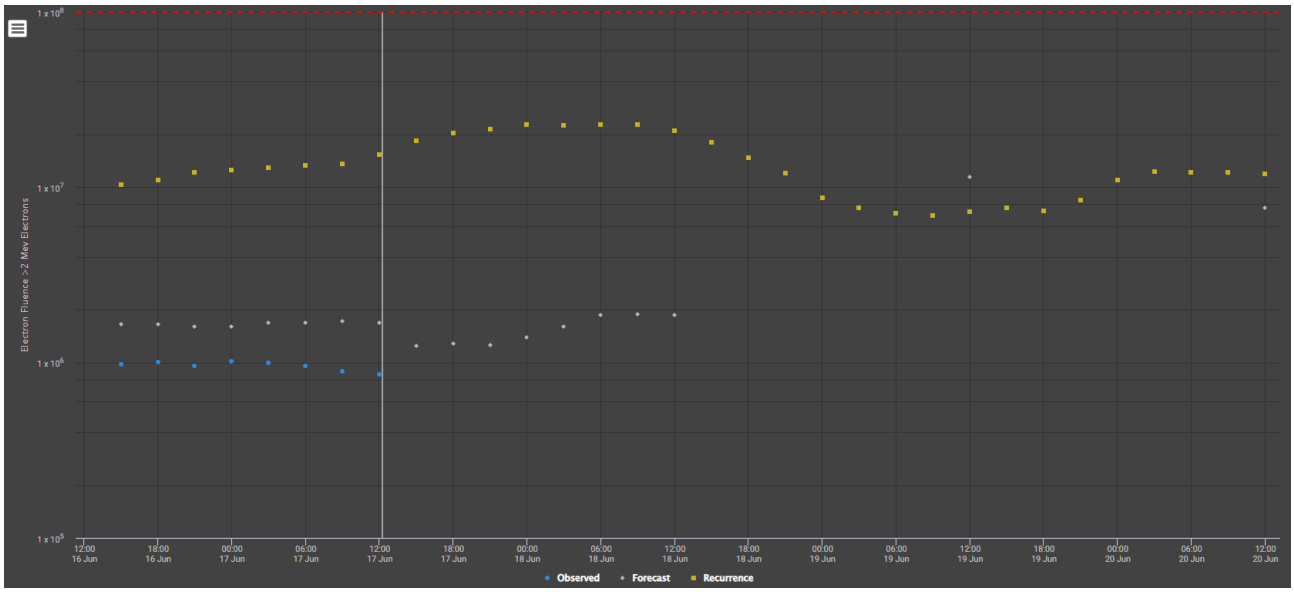
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to persist at mainly Background levels for much of this period, although some diurnal Moderate flux values are likely. This particularly likely later in the period following any enhancement to the electron belts provided by coronal hole influence.

The associated 24-hour fluence is therefore expected to remain below the Active threshold (1e8 integrated pfu) but with a rising trend possible later in the period. MOSWOC REFM considered to provide reasonably good guidance in the near term.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	10	15
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output



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